some instances, too hastily arrived at in the earlier days of their work, before time and experience had shown the necessity of that habit of caution and hesitation which is forced upon a field-geologist more and more as he pursues his work, and which might have prevented such inconsistencies as are illustrated by the case of the "Rotherham Rock," as it is mapped in two different editions of the One-inch Survey Map; or by such a statement as that of Mr. Aveline himself that "a peculiarity of the [Lower Bunter] sandstone is, that it is quite free from the pebbles that characterize the formation overlying it," when a little closer observation might have shown him some half-a-dozen sections within easy reach of Nottingham, in which the pebbles of quartz, quartzite, slate, and grit, are scattered sparsely through the sandy matrix. But these are of course petty matters of detail, worthy only of the attention of that inferior order labelled by Mr. Aveline "local geologists," one of whom has observed a good many of the pebbles in question even in the typical section of Lower Bunter south of Mansfield, which Mr. Aveline refers to in his "Memoir" (p. 12).

I will not intrude further upon your space and your courtesy, except to disclaim, on my own part and that of my co-workers in the same field, any wish to make an attack upon Mr. Aveline or any of his colleagues (several of whom I have the honour and the pleasure to know personally); while, on the other hand, he, no doubt, would be the last to repudiate the notion, that, with all their exceptional advantages, they possess a monopoly of geological knowledge. We have on both sides a strong desire to arrive at the actual truth; and, even if further investigation should prove our position to be altogether untenable, I shall, for my part, be glad, if I have in any way helped to bring this question into the full light of criticism.

VI.—ON PROFESSOR HULL'S CARBONIFEROUS CLASSIFICATION.

By J. R. DAKYNS, M.A.;
of Her Majesty's Geological Survey.

IN a paper read before the Geological Society of London, Prof. Hull proposes, as generally applicable to the whole of Great Britain and Ireland, a new classification of the Carboniferous rocks, as follows:

UPPER CARBONIFEROUS GROUP.

Stage G. Upper Coal-measures	...	...	...	} Essentially freshwater.
" F. Middle Coal-measures	...	...	...	

MIDDLE CARBONIFEROUS GROUP.

Stage E. Lower Coal-measures or Ganister Beds	} Essentially marine
" D. Millstone-grit Series	
" C. Yoredale Series	

LOWER CARBONIFEROUS GROUP.

Stage B. Carboniferous Limestone Series	...	...	} Essentially marine (except in Scot- land).
" A. Lower Shales, Slates, Carboniferous, Cal- ciferous and Sandstone Series	...	...	

There are two points in this classification: one is the division of the whole Carboniferous Series into two portions, distinguished as

freshwater and marine: the other is the further subdivision of the lower or marine portion into two by uniting the Ganister Beds, Millstone Grit and Upper Limestone Shales into a Middle division, and the Carboniferous Limestone and Lower Limestone Shales into a Lower division.

It is difficult to see how the Lower Coal-measures and the Millstone Grit can properly be classed as *essentially* marine in the face of the coal-seams and beds of Ganister, which bespeak land-surfaces: but the proposal to unite the Lower Coal-measures or Ganister Beds with the Millstone Grit has something to recommend it, for the North of England at least, on stratigraphical grounds beyond the palæontological ones relied on by Prof. Hull: for the two sets of beds have much in common; workable coal-seams are not unknown in the Millstone Grit of Derbyshire, and such become more common as we go northward; though the Sandstone Beds are as a rule coarser in the Millstone Grit than in the Lower Coal-measures, yet all Millstone Grits are not coarse; some are very fine; and grits quite as coarse as ordinary Millstone Grits do occasionally occur in the Lower Coal-measures. It is true we have a well-marked top to the Millstone Grit in Derbyshire and Yorkshire: but this I look upon as a happy accident: and were the Permian removed, where it hides the upper part of the Millstone Grit, perhaps we should find the Rough Rock lose its well-marked character or possibly thin away altogether, and then where would our division-line be? But, what is more important, beds of Ganister, which are *the* distinguishing feature of the Lower Coal-measures, occur also in the Millstone Grit: this is the case as far south as Derbyshire; and as we go north the Ganister beds in the Millstone Grit become so prominent that the measures containing them might easily be mistaken for the equivalents of the Lower Coal-measures of South Yorkshire.

Prof. Hull further proposes to class the Upper Limestone Shales with the Millstone Grit. It has always been a difficult matter to separate these two subformations satisfactorily, except for quite limited areas. The line between the two has been drawn in very different places by different observers. The late Prof. Phillips drew the line below the great grit of Pendle Hill: subsequent observers threw the equivalent of this grit, under the name of Yoredale Grit, into the Upper Limestone Shales. But Phillips was undoubtedly right in classing it with the Millstone Grit; for the grit in question is simply the basement bed of the Kinderscout Grit, from which it is often quite impossible to separate it satisfactorily. The name Yoredale Grit, too, is a singularly unhappy one; for it is more than doubtful whether any representative of this grit occurs in Yoredale at all. But in my opinion the term Yoredale, as a synonym for the old term Upper Limestone Shale, is itself incorrect. The type of beds developed in the valley of the Yore is a very marked one; also very peculiar, by no means generally characterizing the beds below the Millstone Grit; it would seem better therefore to retain the old term Upper Limestone Shales for these measures generally, reserving the term Yoredale series for those cases in which the beds approxi-

mate more or less to the type in Yoredale. Considering the peculiar character of the Yoredale beds, so different from the Millstone Grit, I think it would be a mistake to throw them into the same class as the latter group; nor would Prof. Hull find it everywhere so easy, as it is in Derbyshire and Lancashire, to separate the Upper Limestone Shales from the Carboniferous Limestone, the fact being that the thick limestone splits up north-eastward into a number of subdivisions of limestone, sandstone, and shale. I do not myself believe, *pace* Prof. Hull, in the possibility of finding any classification of the Carboniferous rocks applicable to the whole of England, other than the philosophical one recommended by Prof. Ramsay, of treating the whole as one indivisible formation and mapping separately each important bed, or group of beds, of grit, limestone, chert, ironstone, plate, or shale.

VII.—MESOZOIC VOLCANIC ROCKS OF BRITISH COLUMBIA AND CHILE. RELATION OF VOLCANIC AND METAMORPHIC ROCKS.

By GEORGE M. DAWSON, F.G.S.,
of the Geological Survey of Canada.

IN Chile and adjacent regions of South America, Mr. Darwin, in his "Geological Observations," has described a great series of Mesozoic rocks, which he calls the "porphyritic formation," and which shows an interesting resemblance to certain rocks in British Columbia. These I had provisionally designated in my report in connexion with the Geological Survey of Canada for 1875, as the *Porphyrite series*, without at the time remembering Mr. Darwin's name for the Chilean rocks. Many of Mr. Darwin's descriptions of the rocks of Chile would apply word for word to those of British Columbia, where the formation would also appear to bear a somewhat similar relation to the Cascade or Coast Range, which that of Chile does to the Cordillera. By its fossils, the porphyritic formation of Chile is proved to occupy a position intermediate between the Jurassic and Cretaceous, which is much that which the Porphyrites of British Columbia must hold. Beds overlying the Porphyrites on Tattayoco Lake by some thousands of feet—probably conformably—hold fossils characteristic of the Shasta Group or lowest of the Cretaceous in California, which is believed to represent the English Series from the Gault downwards. Fossils collected last summer in the porphyrite and felsite—altered ash rocks—of the Iltasyonco, a branch of the Salmon River in latitude $52^{\circ} 50'$, present a more distinctly Jurassic *faunes*, though their palæontological value will be more certainly known when Mr. Whiteaves shall have finished his examination of them.

Of the South American Series Mr. Darwin writes:¹—"The alternating strata of porphyries and porphyritic conglomerates, and with the occasionally included beds of felspathic slate, together make a grand formation; in several places within the Cordillera I estimated its thickness at from 6000 to 7000 feet. It extends for many hundred miles, forming the western flank of the Chilean Cordillera;

¹ *Loc. cit.* p. 476.